PNFI Technical Reports

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THE WETTING ABILITY OF FOREST FIRE FOAM

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Introduction

Determining the wetting ability of foams at predetermined concentration levels is a precursor to more accurate fuel-specific foam application prescriptions. Reproducible results for forest fuels are not available at present but the wetting ability of foam products can be estimated by the "Standard Method for Evaluation of Wetting Agents by the Skein Test". This is a quick and simple method of comparing products and identifying changes in the rate of absorption relative to the mix ratio. Five gram standard cotton skeins were used to measure the speed of wetting by foam solutions mixed at different concentrations, and comparisons were made using "sinking time", that is, the time lapse between immersion and sinkage of the skein.

Materials and Methods

The apparatus and procedures identified in Standard ASTM D2281 - 68 were used and all tests were conducted with a 3 g hook attached to the anchor. Samples of 1000 mL were prepared with distilled water for mix ratios ranging from 0.1% to 1.0% using each of the four brands of concentrate (FOREXPAN, SILV-EX (A6904), CHEMONICS #103, and MONSANTO WD-881). The solutions were stirred to ensure homogeneity, the required 500 mL transferred to the test cylinder, and the time lapse between the skein's immersion and sinking was measured and recorded. A parallel series of tests was conducted using each of the four brands in the foamed state. The 3 g hook was replaced by a length of 1 mm diameter copper wire having the same mass because the opacity of the bubble mass precluded standard ocular observations. This wire was formed to hook the skein at the required distance above the anchor and, when in service, it stood vertically and protruded above the cylinder. The time of sinkage was identified as the instant the end of the wire tip reached a reference point (at the cylinder rim) during its descent. The mix ratios for the foam trials ranged from [illegible]% and to 2.0%.

The approved 3 g hook (r) used with standard D-2281 tests and the modified 3 g wire system (c) used with opaque wetting agents. On the left is the graduated cylinder used for both tests.

Results and Discussion

The curves for solutions in Figures 1 to 4, show product differences at certain mix levels but they follow the same basic curvilinear relationship. WD-881 and SILV-EX followed the same pathway for the entire 0.1% to 1.0% range. Consequently, every comparison for SILV-EX with other brands also applies to WD-881.

a) SILV-EX vs CHEMONICS #103

- sinking times were the same for solutions up to and including 0.2%, but for richer solutions the wetting rate for CHEMONICS #103 gradually decreased until, at the 1.0% level, it was 100% slower.

b) SILV-EX vs FOREXPAN

- sinking times were the same for solutions in the 0.1% to 0.5% range, but above 0.5%

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the FOREXPAN wetting rate slowed until at 1.0% it was 40% slower.

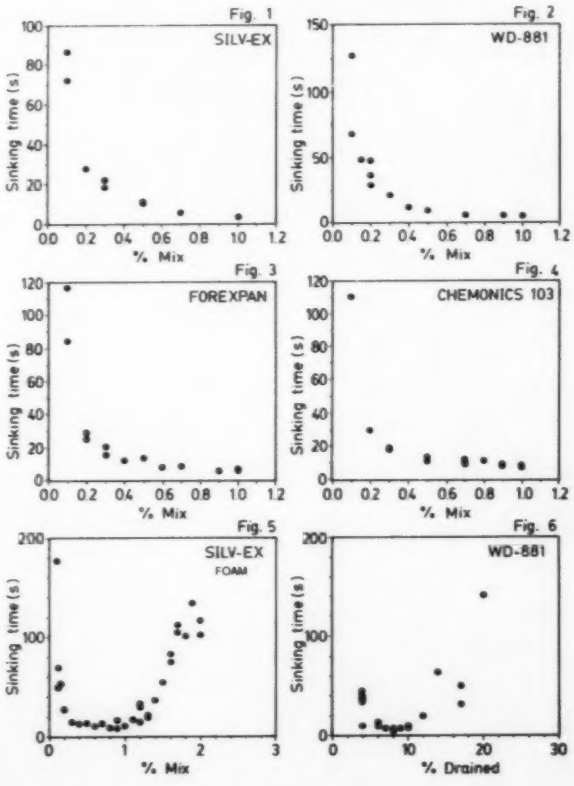
c) CHEMONICS #103 vs FOREXPAN

The curves are comparable but are slightly offset, with sinking times of FOREXPAN in the 0.2% to 1.0% range being about 15% to 20% faster.

Wetting of foam-coated materials occurs only at the rate at which the solution is released as the foam drains. A comparison of SILV-EX sinking times relative to the mix ratio (Figure 5) indicated that sinking time changes decreased rapidly in the 0.1% to 0.3% range, were minimal in the 0.3% to 1.0% range, and increased rapidly as the mix percentage was increased. This upswing was due to slower drainage of the richer, more stable, foams. Sinking times were predominantly in the less than 60 second range.

A second comparison was executed using per cent drained at 1 minute and sinking time. The ideal would have been to use per cent drained at the same time increment as sinking time, but the current system of measuring drainage does not allow for reading much before 1 minute after generation. The plot of this relationship (Figure 6) depicts an unexplainable scatter of points where the sinking time and drainage percentage of some given trials are out of synch. Furthermore, the determination of the amount of fluid accumulated below the foam is very subjective until at least 3.5 g of solution has drained out, so the percentage drained may be quite imprecise at 1 minute for the stable foams.

Figures 1-5: Sinking time curves for various wetting agents. *Figure 6*: Drainage time for Monsanto WD-881.



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